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A COMPARISON OF THE COSTS OF TREATING WASTES FROM A RADIO ANALYTICAL LABORATORY

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ABSTRACT

Statement of the Problem: The Radiological and Environmental Sciences Laboratory (RESL) is a government-owned, government-operated facility at the Idaho National Engineering Laboratory (INEL). RESL's traditional strengths are in precise radionuclide analysis and dosimetry measurements. RESL generates small quantities of various types of waste. Waste management and disposal must comply with numerous environmental laws, orders, and regulations. The disposal of these wastes is an administrative problem and and an economic cost. Waste management may require treating the waste chemically and physically, analyzing, storing, monitoring, and shipping it to on-site or off-site waste, storage, treatment, or disposal facilities. There is a charge associated with each of these steps for each category of waste. The cost for managing mixed waste is large ($34,000). We sought to reduce this cost.

What we did: We reviewed three alternative management approaches for disposing of laboratory mixed waste from a solvent extraction process. The steps in each approach were identified. We made assumptions to permit estimating the component costs. The total cost for each approach was determined, and these totals were compared.

What we found: The current approach to managing certain laboratory mixed wastes costs $34,000 or more a year. One alternative approach would be to treat the hazardous component of the waste in the laboratory, and then to dispose of the remainder as a low-level waste. This option would cost approximately $12,000/year. A second alternative would be to develop a different analytical procedure, which would not produce a hazardous component, and then to manage the waste as low-level radioactive waste. This option would cost approximately $2,000 - $4,000/ year.

What we concluded: If we could integrate policies into the development of methods of waste management, then we might save trouble, and also probably money.

Summary: Properly disposing of laboratory waste is expensive. Appropriate assumptions were made to permit analyzing and comparing costs. Three waste management approaches were examined, and their costs were estimated. Low cost alternatives were identified and will be pursued to improve our waste management practices. The kind of analysis described in this study shows how a laboratory may "do more with less," i. e., to discharge increased responsibilities at less cost.

1. INTRODUCTION

The Idaho National Engineering Laboratory (INEL) is one of the national laboratories of the U. S. Department of Energy (DOE). Its pollution prevention policy is to carry out the intent, and to meet the goals, of the DOE waste minimization (Wmin) and pollution prevention (P2) waste reduction directives. Toward that end, "it is the DOE policy to undertake appropriate measures to limit the generation of contaminants, wastes, and other residual materials requiring disposal or release to the environment" and to "create a pollution prevention ethic within the work place[1]." INEL's mission is to develop, demonstrate, and deploy advanced engineering technology and systems to improve national competitiveness and security, to make the production and use of energy more efficient, and to improve the quality of life and the environment. Areas of primary emphasis at the INEL include waste minimization and management, environmental engineering and restoration, energy efficiency, renewable energy, national security and defense, nuclear technologies, and advanced technology[2]. This report describes three waste management methods for a specific laboratory, it determines their costs, and it estimates potential cost savings.

2. SCOPE OF THE STUDY:

This study identified potential waste management options for a solvent extraction process waste stream and the cost differences resulting from either process changes, improved technology usage, or material substitutions or changes at RESL. Where possible, this report identifies changes that have resulted or may result in waste reduction and cost savings. DOE P2 directs us to review processes, evaluate waste practices, and estimate potential reductions in waste volumes and waste management costs. This study focused on selected processes, but the processes are illustrative of potential waste volume reductions and cost minimizations that may be achieved elsewhere at the INEL and throughout the DOE complex.

3. METHOD USED:

Microsoft Windows 3 .1 interface software was used to develop a data assessment form for assessing a pollution prevention opportunity. The pollution prevention opportunity assessment (PPOA) process was used to study the existing processes and procedures[3]. A form was developed and employed to help gather information and to present waste and cost data. The PPOA procedure and format design works best for production-type operations where many products are produced and where input materials and waste generated may be tracked and assigned costs. However, most of the processes at the INEL are not product-based, but process-based, operations. Further, the processes generated small amounts of hazardous and mixed wastes.

In analyzing a waste disposal process, we allocated component costs to functional categories. These categories included the following:

1. operational costs, included waste generation and collection into a storage area;
2. administrative costs, including worker training, routine inspections, and reporting;
3. disposal costs, including preparing the waste for shipment and disposing of it.

4. CLASSIFICATION OF THE WASTE:

We studied processes used at RESL that generate waste. The Laboratory is in Building 690 at the Central Facilities Area (CFA) of the INEL. RESL is a world-class radioanalysis laboratory. RESL chemists used a solvent extraction procedure to analyze for radioactive isotopes (specifically, plutonium and americium) in water samples. The waste contained hexane, which is RCRA ignitable. Therefore, the waste was classed as hazardous. The analytical procedure used radioactive tracers, which were added to the sample to help measure the concentration of Pu or Am. The analysis usually recovered 85% to 95% of the added tracer. However, the remaining tracer passed through the solvent extraction process to become part of the waste stream. Any content of radioactivity changes the classification from hazardous waste to mixed waste, which is much costlier to manage.

5. ASSUMPTIONS [4]:

The assumptions made at the beginning of the analysis are listed in Appendix A. A detailed description of the procedures and the costs associated with managing this waste stream are included. The hourly rates, which were used to estimate the labor costs in the PPOA, reflected the civil service classifications of various employees involved in each task. The costs/year were based on the time it took the employees to manage the waste, to remove it from the laboratory, to prepare the waste for shipment, to transport it, and to store it at the Mixed Waste Storage Facility (MWSF).

Appendix B shows the costs for an alternative procedure (Option 2. a) that was developed, and that does not generate either a mixed or a hazardous waste. The costs associated with managing the solvent extraction analytical waste were also divided into three functional areas: operations, administrative, and disposal. Existing process costs and estimated costs for waste management options are summarized by functional categories in Table 1. Under worst-case conditions, a low-activity (low-level) radioactive waste may be generated. The low-level radioactive component would be the result of material procedurally required in the analysis. The procedure was published[5]. It has been used at RESL on approximately one hundred samples.

The annual cost for managing solvent extraction process waste streams was calculated to be $34,514 (The use of five digits is not meant to imply that our cost figures are certain to one part in thirty thousand. Cost estimates are probably accurate to within a few percent.) The annual cost of managing the same waste stream under Option 1 (In-lab treatment) was calculated to be $11,543. The cost of disposing of the waste under Option 2. a was calculated to be $2,170. The cost of disposing of the waste under Option 2. b was calculated to be $3,955. Based on the above cost data, validating the alternative analytical procedure and implementing its use would result in a cost reduction of $30,559/year, or 89% less than current solvent extraction waste management costs.

6.0 Radiochemical Solvent Extraction

6.1 Procedure:

A radiochemical solvent extraction procedure for analyzing for two radioactive isotopes (Pu and Am) was performed on water samples by RESL chemists . Five to six samples were analyzed at one time. However, this number may vary depending on the number of samples received for analysis. Each sample volume was approximately 400 milliliters (mL). Wastes were generated from the analysis of each sample. The average amount of waste generated per year was five gallons, or approximately 19 L. This waste was shipped to the MWSF annually, in a single, 30-gallon drum.

The resulting waste volumes were managed as mixed waste because the waste contained hexane, which is RCRA ignitable and therefore hazardous. The waste also contains radioactivity that was added to the waste stream through DOE operations. DOE policy states that "no (statistically) measurable increase in radioactivity" may be caused by DOE operations. . Currently, there is no technical limit [no *de minimus* or below regulatory concern (BRC) value] for radioactivity against which to compare the activity levels of the laboratory waste for purposes of exclusion from regulation. Therefore, the waste has historically been characterized as mixed waste, and managed as such. However, establishment of *de minimus* limits could result in reclassifying the waste stream as a hazardous waste from the solvent extraction process or as an industrial waste under Option 2. a and 2. b.

6.2 Solvent Extraction Cost Analysis

Descriptions of the procedures and the costs associated with managing this waste stream are included in Appendices B and C. The costs were based on the man-hours it took, annually, to manage the waste in the laboratory, remove the waste from the laboratory, and prepare the waste for shipment to and storage in the mixed waste storage facility. Also included is a cost estimate to perform treatability studies to develop a treatment process.

An alternative procedure was developed that does not generate a mixed waste. Under worst-case conditions, a low-activity (low-level) radioactive waste may be generated. The low-level radioactive component would be the result of material added in the analysis or present in the sample received from the customer.

These costs were divided into the following functional areas: operational, administrative, and disposal. Waste management costs are described in numerical order in the appendices and by a number assigned to the following functional categories:

1. operational - items no. 1 and 19;
2. administrative - items no. 2, 4, 5, 12, and 18;
3. disposal - items no. 3, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 20, 21, and 22.

The annual cost for managing solvent extraction process waste streams was $34,514. The annual cost of managing the same waste stream under Option 1 (In-lab. Treatment) was $10,543. The annual cost of managing waste under Option 2. a and 2. b was $1,990 and $3,995, respectively. These costs per management option are shown in Table 1.

Table 1. Radiochemical Solvent Extraction Functional Area Costs, in dollars

Cost Categories	Present Management Costs	Option 1: In-Laboratory Treatment	Option 2. a Discharge & Low-level Disposal	Option 2. b Disposal as Low-level Waste
Operational Costs	945	5,517	990	945
Administrative Costs	3,954	3,954	500	1,264
Disposal Costs	29,615	2,072	500	1,746
Total Costs	34,514	11,543	1,990	3,955

7. Conclusions
Solvent extraction wastes were managed as mixed waste with an annual potential management cost of $34,514. Development of an acceptable treatment technology for in-laboratory treatment or on-site treatment (Option 1) would result in estimated annual management costs of $11,543, which is a reduction from current costs of 67%. Implementation of a recently developed analytical procedure (Options 2. a and 2. b) for achieving the same analytical results as the current procedure would result in estimated annual management costs of $1,990 (option 2. a) or $3,955 (option 2. b). This is a reduction from current costs of 94% and 88%. Based on the cost reductions estimated to be achievable, Options 2. a and 2. b are worthy of pursuit.

DOE policies can also affect the cost of managing waste. If a *de minimus* amount for radioactivity were established, it is probable that the waste management process would be simplified, and waste management costs could be reduced.

Finally, a review of waste generating processes provides opportunities for waste management improvements and cost reductions. These kinds of efforts also improve the confidence of the public in DOE's ability to change waste management practices for the better.

References

1. Memorandum from John C. Tuck, Under Secretary of Energy, Peter N. Brush, Acting Assistant Secretary, Environment, Safety, and Health, Leo P. Duffy, Director, Office of Environmental Restoration and Waste Management, to Distribution [all elements of the Department of Energy], "Waste Reduction Policy" (June 27, 1990).

2. U. S. Department of Energy, 1994 INEL Site-specific Plan Summary, DOE/ID-10253 (FY94).

3. U. S. Department of Energy, Process Waste Assessment Approach, Training, and Technical Assistance for DOE Contractors, Annual Report for FY-1993, Allied Signal, Inc., Kansas City Division, March 25, 1994.

4. Pole, S. B., and Conner, A. M., 1995, "INEL Pollution Prevention Opportunity Assessments: Detailed Process and Cost Analyses," INEL-95/0353, September.

5. F. D. Hindman, "Actinide Separation on Bioassay Materials for Alpha-Particle Spectrometry," Radioactivity and Radiochemistry, 6, 4 (1995), 34-41.

Appendix A: Assumptions Made and Data Used to Calculate the Cost of Waste Management

The following cost assumptions and procedural steps are based on managing waste from the solvent extraction process.

1. Laboratory Waste Management Costs. The procedure followed to manage the waste in the laboratory and Satellite Accumulation Areas (SAAs) include:

a. Removing the waste storage container(s) from the SAA;
b. Pouring the waste into the waste storage container(s);
c. Checking the container(s) for integrity and fullness;
d. Recording volume, date, and initials in the SAA Log Book;
e. Returning the container to the SAA.

The total time to perform these steps for six samples of waste was twelve minutes. The time to accumulate the 19 L disposed of in each shipment was 21 hours (19,000 mL/180 mL * 12 min./60 min./hr.) The work was performed by Civil Service Grade GS12 to GS14 chemists. The average gross salary among these grade was $54278. This average was used in this study. The Idaho Field Office (Doe-ID) adds 26% for payroll, taxes, and benefits, and $25,000 for other costs. Thus, the cost of their labor was $45/hr ($54,278 * 1.26 + $25,000 = $93,390/year. $93,390/year / 2,000 work hours/year = $45/hour). The time of the chemists cost $945 (21 hours * $45/hour).

The cost of utility services (electricity, water, sewage, heating, and air conditioning) was assumed to be negligible relative to the overall laboratory utility cost, so this cost was neglected.

2. SAA Inspection Costs. The SAA was inspected monthly, which included completing the SAA checklist. The inspection was performed by a GS12 to GS14 chemist. This inspection took ten minutes each month for a total of two hours a year [(10 min./month * 12 months/year) / 60 min./hour]. This labor cost was $90 (2 hours * $45/hour).

3. Waste Disposal Preparation Costs. The cost for waste disposal included the time to complete forms 669 and 669A and to submit them to Waste Reduction Operation Complex (WROC) technical programs. This took 2 hours. Collecting the waste, logging it into the data base, and packaging and labeling it took about six hours. Coordinating the disposal with WROC, responding to questions, concurring with approvals, and submitting the waste to inspection took two hours. This work was performed by waste management personnel at an average total cost of $96/hour and costs $960 [(2 + 6 + 2) hours * $96/hour].

4. WROC Support Costs

This support included an administrative review and approval of the 669 and 669A forms, communicating with the Treatment, Storage, and Disposal Facility (TSDF) vendor, and interfacing with the waste owner. This support was provided by WROC technical programs personnel at an average minimum cost of $60/hour and required approximately 4 hours for each shipment. The cost was $ 240 (4 hours * $60/hour).

5. Current Data Base Information Costs. These activities included contacting staff maintaining the New Waste Management Information System (NWMIS) or the Radioactive Waste Management Information System (RWMIS), completing data forms, and confirming entries made to the data bases. Data base personnel within the waste management organization performed this work and spent approximately one hour at a cost of $56 (1 hour * $56/hour).

6. Waste Shipment Coordination Costs. Coordination of the shipment included contacting transportation support, scheduling the shipment, and coordinating shipping clearances. The coordination activities took a minimum of 6 hours/shipment. These activities were performed by traffic personnel at an average cost of $32/hour for a cost of $192 (6 hours * $32/hour).

7. Safety Support Costs. Safety personnel provided safety inspection support for each shipment for one hour at $55 (1 hour * $55/hour).

8. Radiation Control (RADCON) Support Costs. RADCON personnel provided radiation survey support for each shipment for approximately one hour at $55 (1 hour * $55/hour).

9. Waste Shipment Release/Sign-off Costs. An administrative release/sign-off to complete the shipment paperwork was provided by the traffic personnel and required approximately one hour/shipment for $32 (1 hour * $32/hour).

10. Miscellaneous Personnel Support Costs. Other miscellaneous support was provided by the Facilities and Maintenance organization, such as yardmen, scheduler, equipment operators, miscellaneous craft support, etc., depending on the requirements of each shipment. The estimated time spent on this support was four hours/shipment at an average personnel cost of $45/hour for a minimum cost of $180 (4 hours * $45/hour).

11. RESL Personnel Support Costs. Waste management personnel, located at the RESL, provided support for each shipment. This was approximately two hours/shipment for $192 (2 hours * $96/hour).

12. Waste Shipment Close-out Costs. Traffic personnel closed-out each shipment. This included completing the shipping manifest, obtaining the sign-offs, and monitoring the shipment. This work required approximately one hour/shipment for $32 (1 hour * $32/hour). Included in closing out each shipment were receiving shipment copies and setting up files. These activities were performed by waste management personnel for one hour/shipment for $96 (1 hour * $96/hour). The total cost for waste shipment close-out was $128 ($32 + $96).

13. Cost of Waste Shipment to MWSF. There was one shipment a year at $5.94/mile. The MWSF is 5.8 miles from RESL, so the cost is $34.45/shipment (5.8 miles * $5.94/mile). The cost/mile for shipping contact-handled waste was taken from report no. EGG-WM-10877, "Waste Management Facilities Cost Information for Transportation of Radioactive Materials." The travel distances between facilities at the INEL were taken from the "INEL Site Development Plan."

14. MWSF Storage costs. The minimum cost to store mixed waste at the MWSF was $6.50/gallon-year. This cost was based on the container's volume. It cost $195/year to store one 30-gallon overpack ($6.50/gallon-year * 30 gallons). The cost of storing waste at the MWSF was obtained from Thomas Shea, WROC. The average budget to operate the MWST was divided by the total gallons in storage ($400,000/61,496 gallons = $$6.50/gallon)..

15. Waste Shipment to RWMC Costs. Once the mixed waste was treated and solidified, a MWSF waste manager prepared it for shipment and storage. The component activities included:

1. placing the waste in a 30 gallon overpack container;
2. adding an absorbent if the waste contained sludge;
3. ensuring that the packaging met the appropriate waste acceptance criteria (WAC).

Waste management personnel costs are $96/hour. The minimum cost is $288 (3 hours * $96/hour). There was one shipment/year to RWMC at $70.09 (11.8 miles * $5.94/mile). The total cost to ship the waste from the MWSF to RWMC is $358 ($288 + $70).

16. RWMC Disposal Costs. The cost of disposal at the RWMC, averaged over five years, was a minimum of $122/cu. ft. This did not include the cost of the future closure, surveillance, and maintenance activities that will be required at the RWMC. (These costs, if included in this analysis, would significantly increase the costs of disposing of the waste at RWMC, resulting in increased economic benefit of disposing of this waste as an alternative waste type.) The minimum cost to dispose of mixed waste at RWMC was $82/cu. ft.-yr. ($122/cu. ft.-yr. / 7.48 gal/cu ft. * 5 gallons). The RWMC disposal costs were taken from INEL-94/-281, "Waste Minimization and Pollution Prevention: Pollution Prevention Opportunity Assessments and Cost Analyses," by S. B. Pole and J. E. Francfort (1994).

17. Administrative. The components of waste management administrative costs included the following:

1. routine inspections of storage areas;
2. quarterly and annual reports;
3. scheduled environmental meetings;
4. training for waste managers.

Administration may require 120 hours/year allocated among the principal waste streams. The cost was 30 hours/waste stream at $96/hour, plus approximately 10 hours/year/waste stream for technician support, at $56/hour. The total administrative costs $3,440.

18. Treatability Study Process Costs. Treatability studies included approximately 100 hours of laboratory work plus 200 hours of miscellaneous administrative and office work. If the waste includes sludge, an additional 16 hours is generally needed for a treatability study. This work is performed by chemists in the LITCO Chemical and Environmental Engineering organization. The cost of minimum analytical support for each treatability study was $2,000. The minimum cost for a treatability study, including sludge analysis, is approximately $27,280 [(316 hours * $80/hour) + $2000]. This cost may double if it is found that the proposed treatment does not work, so another treatability study is needed to find a stabilization treatment

Total Cost of Managing Mixed Waste by Solvent Extraction. The total cost for the mixed waste was $34,547/yr., calculated as follows:

1. Lab waste management costs	945
2. SAA inspection costs	90
3. Waste disposal preparation costs	960
4. WROC support costs	240
5. Current data base information costs	56
6. Waste shipment coordination costs	192
7. Safety support costs	55
8. RADCON support costs	55
9. Waste shipment release or sign-off costs	32
10.Miscellaneous personnel support costs	180
11. RESL personnel support costs	192
12.Waste shipment close-out costs	128
13.Waste shipment to MWSF costs	34
14.MWSF storage costs	195
15.Waste shipment to RWMC costs	358
16.RWMC disposal costs	82
17.Administrative costs	3,440
18.Treatability study process costs	27,280
Total	$34,514

If an additional treatability study were necessary, the cost could increase to $61,794 ($34,514 + $27,280).

Casual estimates of costs are inaccurate. It is important to observe the component activities, calculate their associated cost(s), and determine the true cost to do business. The personnel costs cited may seem high. However, these costs include the workers' gross pay, the employer's contributions to health insurance, pension, thrift savings plans, life insurance, social security, Medicare, and taxes, plus there was an administrative component of cost. The "fully burdened" cost is 2 to 3 times the worker's gross wage. When examined in detail, all processes were found to have more steps and greater costs than our first estimates. The reader may feel that a great many operations are performed on the waste. That is true, but nevertheless, intervenor groups feel that far too little waste processing and monitoring is done. Administrators are constantly examining costs to minimize them wherever possible.

Salaries constituted the largest single component of costs. To cut costs, we believe that the role of each person who deals with the waste must be thought through again. This is the main challenge of pollution prevention and cost minimization. Included in the "fully burdened" cost are the component costs of providing an office and/or a laboratory for the worker, lighting it, heating it, cleaning it, maintaining it, administering it, insuring it, etc. Other costs are worker training, worker health promotion programs, safety meetings, etc.

Appendix B. Alternative Procedures and Their Costs

Option 1: In-Laboratory Treatment and Disposal as Low-level Waste
If the waste were treated at the laboratory of origin so that it could be classed as low-level waste, then the cost would decrease. Most of the previous steps would be necessary, plus two additional steps.

19. Waste Treatment Costs. This work included purchasing the materials and equipment needed to treat the waste, assembling the process and equipment, and performing the treatment. A solidification process was determined to be an acceptable in-laboratory process. The purchasing and set-up costs are one-time costs. The actual costs of performing the treatment are incurred each time the process is run. If the waste were treated at the point of generation, no additional treatment permits would be required. Such a treatment could be set up in a RESL laboratory room, if space were available. We estimated that it would take 32 man-hours/5 gallons of waste/year, and it would cost $3,072 (32 man-hours * $96/man-hour). The analytical costs to ensure compliance of the final waste with RCRA would be approximately $1,500. The total treatment costs would be $4,572.

20. Cost to Ship Waste from RESL to RWMC. The waste would be prepared for shipment by a process like the one described in Step. 16, at a labor cost of $288/year. The difference would be that the waste would be shipped from RESL to RWMC. There would be one shipment/year, and it would cost $35.64 (6 miles * $5.94/mile). The total cost to ship the solvent extraction waste from the RESL to the RWMC would be $324/year ($288 +$36). If a suitable treatment process were developed, it would eliminate on-going costs of treatability studies and storage in the mixed waste storage facility.

The cost for managing the solvent extraction waste was estimated to be $11,543/year, calculated as shown below:

1. Lab waste management costs	945
2. SAA inspection costs	90
3. Waste disposal preparation costs	960
4. WROC support costs	240
5. Current data base information costs	56
6. Waste shipment coordination costs	192
7. Safety support costs	55
8. RADCON support costs	55
9. Waste shipment release or sign-off costs	32
10. Miscellaneous personnel support costs	180
11. RESL personnel support costs	192
12. Waste shipment close-out costs	128
16. RWMC disposal costs	82

17. Administrative costs	3,440
19. Waste treatment or solidification costs	4,572
20. Cost to ship waste from RESL to RWMC	324
Total	$11,543

APPENDIX C. OPTION 2. a :Cost to Dispose of Waste by Discharge

If the analytical procedure were changed such that the waste was not RCRA hazardous, then the waste would no longer be a mixed waste. A new analytical procedure was developed, but it has not yet been sufficiently tested to be accepted as an alternate procedure. The new procedure generates a low-activity waste, rather than a mixed waste. The waste manager need only collect and neutralize the waste and, assuming the waste meets discharge limits, discharge the waste to the waste water treatment system. This would take the DOE-ID chemist one hour/week to neutralize the five gallons/year generated. If the new procedure met quality requirements for analytical results, and if the waste also met the RESL limits for radioactive discharge, then in-laboratory waste management is estimated to cost $1,170/year (1/2 hr/week * 52 weeks/year * $45/hour). Analytical and administrative support may add approximately $1,000/year for a total cost for option 2. a of $2,170/year.

Option 2. b: Cost to Dispose of Waste as Low-Level Waste

If the waste did not meet the radioactive discharge limits, then it would have to be disposed of as low-level waste. This would increase the overall cost of waste management using the proposed procedure to approximately $6,165 ($2,170 discharge cost + $3,995 cost to dispose of waste at the Idaho Chemical Processing Plant (ICPP).

18. Administrative. Administrative costs would be approximately half of RCRA-based costs, or $840.

21. Cost to Ship Liquid Waste to the ICPP. There would be one shipment/year, at a cost of $20.20 (3.4 miles * $5.94/mile). The cost of $12/gallon to handle and to treat liquid waste at the ICPP was provided by Kent Miller, ICPP.

22. Cost to Treat Liquid Waste at ICPP. This cost would be $60 (5 gallons * $12/gallon).

The component costs are listed below:

1. Laboratory waste management costs	945
3. Waste disposal preparation costs	960
4. WROC support costs	240
5. Current data base information costs	56
6. Waste shipment coordination costs	192
7. Safety support costs	55
8. RADCON support costs	55

9.Waste shipment release or sign-off costs	32
10. Miscellaneous personnel support costs	180
11.RESL personnel support costs	192
12. Waste shipment close-out costs	128
18. Administrative costs	840
21. Cost to ship liquid waste to ICPP	20
22. Cost to treat liquid waste at ICPP	60
Total	$3,995

SUMMARY

If the solvent extraction process could be changed to eliminate the hazardous component (hexane), then the classification of the waste could be changed from mixed to low-level, and the cost/year to manage the waste could be greatly reduced under either option 1 or 2.

Table B-1. Solvent extraction process waste options

Option	Cost/year
Current cost to manage mixed waste	$34,514
Option 1: Treatment cost	$11,543
Option 2a. Cost to neutralize and discharge	$2,170
Option 2b. Cost if reclassified as low-level waste	$3,995